Encouraging knowledge contribution in IT support: social context and the differential effects of motivation type

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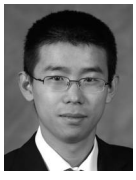

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Abstract

Purpose – *This paper aims to investigate how to promote two types of knowledge contribution tasks. The authors focus on the role of supervisor and coworker support on motivation, and their effects on two different contribution tasks. Motivating employees to contribute knowledge is quite challenging. While previous studies have tried to understand how to promote knowledge contribution, few have differentiated between knowledge contribution tasks.*

Design/methodology/approach – *Information technology support was chosen as the context of this study, and data were collected from system administrators within a Fortune 500 company via a web-based survey.*

Findings – *Results show the differential effects of two forms of motivation on different contribution tasks, and supervisor support is positively associated with intrinsic motivation. Specifically, while intrinsic motivation is positively associated with challenging knowledge contribution, external motivation is positively related to mundane knowledge contribution and negatively related to challenging knowledge contribution.*

Originality/value – *This study contributes to the current literature by providing a deeper theoretical understanding of knowledge contribution tasks, and contributes to practice by offering suggestions on how to better motivate employees within organizations and promote different knowledge contribution tasks.*

Keywords *Supervisor support, Knowledge contribution, Intrinsic motivation, External motivation, Information technology support, System administrator*

Paper type *Research paper*

1. Introduction

Knowledge management systems (KMSs) are defined as:

> [. . .] a class of information systems applied to managing organizational knowledge. That is, KMSs are IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application (Alavi and Leidner, 2001, p. 114).

One of the most challenging issues of KMSs is knowledge contribution (Wasko and Faraj, 2005; Kankanhalli *et al.*, 2005; Boh and Wong, 2013), because a KMS can only be as useful as the knowledge it contains. Knowledge contribution refers to the process of contributing knowledge into electronic repositories of KMSs (Alavi, 2000). KMSs have different models, and this study focuses on the repository model, which emphasizes codification and storage of knowledge to facilitate knowledge reuse (Alavi, 2000). Therefore, knowledge contribution is vital to the success of KMSs in the repository model.

Organizations often encourage their employees to contribute knowledge into KMSs so that other employees can apply the knowledge contributed (Derr, 1999; Garud and Kumaraswamy, 2005; Liu *et al.*, 2010). However, since the use of KMSs is often voluntary, and taking time to contribute knowledge may take time away from their primary job responsibilities, employees can choose whether or not to contribute knowledge into KMSs.

> **"Knowledge contribution is vital to the success of KMSs in the repository model."**

In such a context, there is a disparity between work and benefit: the value of a KMS is often realized when individuals use knowledge from the KMSs and the effects are aggregated to the organization level. However, the knowledge contributor doesn't directly benefit from the time they spend sharing their knowledge. As a result, individuals may not perceive any direct benefit for their contribution (Stenmark and Lindgren, 2006). A significant challenge for practitioners, therefore, is to better understand how to promote knowledge contribution to KMSs (Kankanhalli *et al.*, 2005).

While previous studies have tried to examine various ways to motivate knowledge contribution (Alavi and Leidner, 2001; Golden and Raghuram, 2010; Kankanhalli *et al.*, 2005; Reinholt *et al.*, 2011; Thomas-Hunt *et al.*, 2003; Wasko and Faraj, 2005), few studies differentiate among knowledge contribution tasks. This is important because the literature suggests that the effect of different types of motivation may depend on the type of task (Gagne and Deci, 2005), and it is unlikely that "knowledge contribution" is always the same. Therefore, the effects of different types of motivation on different contribution tasks may not be well-understood without differentiating between contribution tasks. Furthermore, while research has investigated the effects of social influences on knowledge contribution directly, few studies have instead looked at the effects of these factors on motivation as a mediator to knowledge contribution; this differentiation is important because motivation theories suggest that social factors cannot directly cause knowledge contribution, but can only encourage knowledge contribution through motivation (Deci *et al.*, 1989).

To summarize, there is a need to examine different types of knowledge contribution tasks, the effects of motivation on these different types of knowledge contribution and the social antecedents to motivation. Therefore, the research question for this study is:

RQ1. How are different knowledge contribution tasks promoted by different types of motivation, and how is motivation affected by social factors in organizations?

This study has two main goals. The first goal is to investigate the effects of motivation on knowledge contribution. In this effort, this study includes two types of motivation: intrinsic motivation and external motivation (Gagne and Deci, 2005; Foss *et al.*, 2009). Intrinsic motivation, which deals with one's internal satisfaction from performing a task or activity (Bock *et al.*, 2008; Gagne and Deci, 2005; Murray, 1964), is included to recognize that knowledge workers can be motivated from within (Garud and Kumaraswamy, 2005). External motivation, dealing with monetary reward or reputation, is one of the most common motivators used in organizations (Elson, 2003; Gagne and Deci, 2005), but it may not be effective in knowledge contribution (Bock and Kim, 2002). Different types of knowledge contribution are considered in this study because research suggests the efforts of contribution may differ, and thus may require different types of motivation (Markus, 2001). That is, knowledge contribution is expanded to include two kinds of knowledge contribution tasks that are common among knowledge workers (Markus, 2001):

1. knowledge contribution that is challenging and interesting; and
2. knowledge contribution that is mundane and boring.

This expanded view of knowledge contribution can better explain inconsistent findings in prior research regarding the effects of motivation on knowledge contribution.

Note that the terminology used is consistent with previous literature (Foss *et al.*, 2009). According to Ryan and Deci (2000), different types of motivation have different levels of self-determination. When the level of self-determination is high (e.g. under intrinsic motivation), people are more autonomously motivated. In such a context, people are more likely to accept the rationale of certain behaviors and these behaviors probably become congruent with their own interests. When the level of self-determination is low (e.g. under external motivation), people are control motivated, likely feel pressured and poorly integrate the behaviors into their own interests. This study does not simply use extrinsic motivation because extrinsic motivation can be either autonomous or controlled (Ryan and Deci, 2000), and this study only focuses on one specific type of extrinsic motivation: external motivation. While this study can be limited, this distinction is important because it opens the door for future studies examining other types of extrinsic motivation.

The second goal of this study is to understand how social factors in organizations can support motivation to contribute knowledge. Knowledge contribution can be quite challenging and time-consuming, and people may initially engage in knowledge contribution because it is valued or promoted by others whose opinions they value. As people frequently interact with their supervisors and coworkers within the organization, this study focuses on the role of supervisor and coworker support on intrinsic motivation. Previous literature has found that social-contextual factors have a significant impact on employees' motivation (Ruppel and Harrington, 2001), and one important social-contextual factor that has been well-recognized is supervisor support in organizations (Deci *et al.*, 1989). Supervisor support refers to the overall level of helpful social interaction available on the job from supervisors (Karasek and Tbeorell, 1990), and involves providing meaningful information in a non-manipulative manner, offering opportunities for choice and encouraging self-initiation (Deci *et al.*, 1994). Previous literature has found that supervisor support promotes self-motivation, especially when the support is more autonomy-oriented (Baard *et al.*, 2004).

On the other hand, less studied is the effect of other social actors on intrinsic motivation. Knowledge workers spend significant time with coworkers, and knowledge management (KM) research suggests that coworker support plays a role in knowledge contribution (Kulkarni *et al.*, 2006). Therefore, this study also investigates the effect of coworker support on intrinsic motivation and discusses the differences of support between supervisors and coworkers. By investigating the role of supervisors and coworkers in promoting knowledge contribution, this study helps better explain how to motivate employees and encourage corresponding knowledge contribution tasks from the perspective of organizations.

The authors select information technology (IT) support as the study context because of the growing importance of IT in organizations. No modern companies operate without IT, and in many organizations, the human costs to maintain and support IT far exceed the costs of hardware and software (Anderson, 2002). As today's computing environments grow in scale and complexity, the work to maintain IT also becomes more complex (Bailey *et al.*, 2007; Barrett *et al.*, 2004). In response, many organizations are implementing KMSs to assist their IT support professionals (Lenchner *et al.*, 2009).

"Since the use of KMSs is often voluntary, and taking time to contribute knowledge may take time away from their primary job responsibilities, employees can choose whether or not to contribute into KMSs."

> **"Practitioners should be aware that there are different types of knowledge contribution tasks."**

This study contributes to current KM literature in several ways. First, this study explicitly investigates different knowledge contribution tasks. Second, the authors posit that different contribution tasks are promoted by different types of motivation. Recent literature has shown that people with various types of motivation may have different participating behaviors after crisis (Wang, 2014). This study expands recent literature by examining how various types of motivation result in different knowledge contribution behaviors. Third, this study clarifies the role of supervisors and coworkers and their impact on intrinsic motivation. While this study is conducted in the context of IT support professionals, understanding the effects of motivation on knowledge contribution is important in several fields where organizational knowledge is held by individuals who are costly to replace, such as consulting and accounting (Foss *et al.*, 2009; Markus, 2001).

The remainder of the paper is organized as follows. First, two different types of knowledge contribution behaviors in the context of IT support are presented. The authors then introduce the theoretical foundation and develop hypotheses. Next, the hypotheses are tested with data from a Fortune 500 company. The paper then closes with a discussion of the theoretical and practical implications of the study.

2. Knowledge contribution tasks

Knowledge contribution is essential to KMS success, yet previous KM literature often treats knowledge contribution as a unitary concept (Kankanhalli *et al.*, 2005; Phang *et al.*, 2009; Wasko and Faraj, 2005). One notable exception is from Boh and Wong (2013), who differentiate knowledge-sharing mechanisms. Some other studies differentiate intention to share knowledge. For example, Bock *et al.* (2005) examine two types of intention to share knowledge:

1. intention to share explicit knowledge; and
2. intention to share implicit knowledge.

However, they do not examine the actual knowledge contribution tasks. This study investigates actual knowledge contribution tasks, and argues that knowledge contribution tasks may differ in their complexity or interest level, a view that has been supported by analysis of previous knowledge-sharing research (Markus, 2001). This distinction provides a more nuanced view of the effects of motivation on different knowledge contribution tasks.

Motivation literature has long looked at the effects of different types of motivation on different work tasks (Kanfer, 1987; Kanfer and Ackerman, 2004). Within self-determination theory (SDT) literature, tasks can be classified according to their level of difficulty or interest (Gagne and Deci, 2005). For example, Butler and Nisan (1986) found that challenging and interesting tasks were influenced by motivation differently than were tasks that were boring and mundane. Following previous literature that classifies work tasks by worker interests, the authors argue that knowledge contribution tasks may also be challenging and interesting or mundane and boring. In the next section, the authors describe different kinds of knowledge contribution tasks in the context of IT support.

2.1 Knowledge contribution tasks in the context of IT support

This study examines knowledge contribution in the context of IT support. The IT infrastructure of organizations comprises multiple hardware and software components

(e.g. databases, servers and networks). As such, IT support has emerged as a significant component of conducting business due to the large scale and complexity of IT infrastructures (Anderson, 2002). System administrators (SAs) are the primary workers in the maintenance of these IT infrastructures, and their work requires specialized skills and knowledge. The costs of this support are quite high, and a key challenge for organizations is to increase SAs' efficiency to maximize productivity. Because SAs share a community of practice and provide documentation for similar others (Barrett *et al.*, 2004), this research may provide insights into knowledge reuse among other shared work practitioners, such as consultants and physicians (Markus, 2001).

In such a context, KMSs can facilitate storing and reusing valuable knowledge specific to an organization's unique environment that is not available in external knowledge sources (e.g. server IP addresses, configuration files, etc.). KMSs can be implemented to provide SAs with access to relevant knowledge related to IT support tasks in their environment, thereby increasing SAs' efficiency. Before SAs can leverage knowledge from a KMS, the KMS must first be populated with content. In IT support work, there are two stores of knowledge commonly used:

1. traditional knowledge bases, which hold knowledge documents; and
2. a ticketing system, such a Bugzilla, where technical teams track problems, system updates and server maintenance (Barrett *et al.*, 2004; Velasquez and Weisband, 2008).

KMS research in other contexts has also reported knowledge bases that hold different types of knowledge documents (Markus, 2001). In the current study, SAs had access to both kinds of knowledge through a single KMS provided by the organization, and could contribute knowledge to each through the KMS.

The first type of knowledge contribution is the traditional method of knowledge contribution in a KMS. In such a situation, SAs contribute knowledge via documents; this task is similar to the "deliberate, after-the-fact strategy" of knowledge contribution outlined by Markus (2001, p. 60). In this process, SAs compose a structured summary, best practice document or process document and upload it to the repository. While a single document may contain information related to several problem tickets, these documents will not address any specific problem tickets in detail. For example, a knowledge document may outline the process for upgrading a server, which will likely include some best practices and lessons learned by working on tickets, but the document will not contain detailed server configuration information for a particular server that has been upgraded.

After SAs upload this knowledge to the KMS, the content is available to others with access to the system. Therefore, these documents are general purposes and contain more basic and fundamental knowledge than problem tickets in a formal, structured format. As such, this knowledge contribution task is relatively mundane: it summarizes past work that is well-understood or may outline steps to follow when performing low-level, often-repeated general work. In addition, these documents are not appropriate for responses to challenging issues or unique problems, because the information they contain must be high-level and generalizable across contexts. Therefore, the authors term this *mundane knowledge contribution.*

In contrast, an SA may also contribute knowledge when he/she completes an IT support task and closes a problem or change ticket. This task is analogous to knowledge contribution that occurs during the execution of work tasks and is seen among other

"Different knowledge contribution tasks are promoted by different types of motivation."

knowledge workers such as consultants (Markus, 2001). Tickets are used for both reactive and proactive work; examples include detailing steps taken when reactively working on a problem in the system, such as restoring a server that has gone offline, or recording information when proactively installing a scheduled software update. In both cases, the ticket includes detailed contextual information, such as the server being worked on and its current operating system, and the SAs may enter a description of what was done so that others can read the ticket, understand the possible issues and determine the actions taken. These descriptions often contain shorthand, acronyms and outlines of tasks completed.

Again, after tickets are submitted, the content is available through the KMS for other SAs. As SAs perform their work, the complexity of their IT infrastructure introduces challenges and surprises, even when performing routine tasks. Therefore, tickets summarize work that is interesting and challenging, and these work characteristics will also be associated with the knowledge contribution task accompanying the work. Therefore, the authors call this *challenging knowledge contribution.*

Based on the discussions above, the key difference between challenging and mundane contribution is the nature of the knowledge shared. Challenging knowledge contribution probably contains specific contextual details such as how to update software by considering the specific system characteristics (e.g. corresponding operating systems, current version and other potential conflicting software). On the other hand, mundane knowledge contribution may contain generalized knowledge without detailing specific contextual details, which SAs can be quite familiar with. Therefore, challenging knowledge contribution requires a high level of engagement and efforts from SAs, while mundane knowledge contribution does not. Following this logic, the type of knowledge contribution does not depend on SAs' experiences or abilities. Even a nascent SA can conduct challenging knowledge contribution by describing the steps taken to solve a recent problem, while an experienced SA may decide to contribute mundane knowledge to obtain some external rewards.

Although the concepts of mundane and challenging knowledge contribution are described in the context of IT support, they could be generalized to other contexts. In general, mundane knowledge contribution can include structured content, which describes basic and generalized knowledge, while challenging knowledge contribution probably includes unstructured content with more difficult and contextual information. Therefore the exact meaning of mundane and challenging knowledge contribution can be adapted depending upon the specific context. For example, in the context of software development, mundane knowledge contribution can include a standardized or agile software development process (Humble and Russell, 2009), while challenging knowledge contribution may describe the details and difficulties encountered when developing a specific software component or function.

The authors also note that the classification of mundane and challenging knowledge contribution focuses on the actual content included and effort involved during contribution. Therefore, this classification is different from other classifications in the literature. For example, depending on the knowledge transfer channels, knowledge contribution can also be divided into formal versus informal knowledge contribution (Holtham and Courtney, 1998). Here, formal transfer mechanisms include training sessions and plant tours, and informal transfer mechanisms can include unscheduled meetings, informal seminars or coffee break conversations. Formal/informal knowledge contribution can be either mundane or challenging, depending on the actual knowledge contributed.

To summarize, knowledge contribution tasks can be classified as interesting and challenging or mundane and boring. This study investigates knowledge contribution tasks in IT support work following such a classification. While knowledge contribution through tickets summarizes interesting and challenging work, knowledge contribution through

documents involves mundane and boring work. In the next section, the authors describe the theoretical foundation and hypotheses developed based on previous literature.

3. Theoretical foundation and hypotheses development

The main theoretical foundation of this study is SDT (Ryan and Deci, 2000). SDT explains individuals' "inherent growth tendencies and innate psychological needs that are the basis for their self-motivation as well as for the conditions that foster those positive processes" (Ryan and Deci, 2000, p. 68), providing a framework through which the authors can investigate not only the outcomes of motivation, but also the supporting conditions of motivation.

3.1 Motivation

According to SDT (Ryan and Deci, 2000), one's intention to act is termed motivation (as opposed to "amotivation", wherein one has no intention to act). SDT identifies different types of motivation, which include extrinsic motivation (external regulation, introjected regulation, identified regulation and integrated regulation) and intrinsic motivation. These different types of motivation differ by the degree to which they are self-determined, with external motivation having the lowest level of self-determination and intrinsic motivation having the highest level of self-determination. This study investigates intrinsic motivation and external motivation (Gagne and Deci, 2005). Intrinsic motivation is more autonomy-oriented, and is due to one's inherent interest or joy in the activity (e.g. doing something because it is enjoyable). The authors include intrinsic motivation because its importance in KMS use has been recognized (Bock *et al.*, 2008), but its antecedents are not well-understood in knowledge contribution. External motivation, more controlled-oriented, is the least self-determined, and people may act because of purely external reasons (e.g. doing something because of monetary rewards or reputation). The authors include external motivation because it is one of the most common motivators used in business (Elson, 2003).

3.2 Social factors and intrinsic motivation

SDT recognizes the positive effect of social-contextual factors on intrinsic motivation, and suggests that words of encouragement and praise related to the task at hand help support intrinsic motivation (Deci *et al.*, 1999; Gagne and Deci, 2005). SDT posits that organizational climates that satisfy the need for relatedness will provide a secure relational base, which can support workers' intrinsic motivation (Gagne and Deci, 2005; Foss *et al.*, 2009). Specifically, SDT argues that this encouraging feedback from others in one's social context can satisfy one's need for relatedness and increase one's self-determination, which in turn supports intrinsic motivation. The need for relatedness states that people have a need to "fit" into their social world, and that this "fit" happens as one takes the messages and norms from others in their social context and internalizes them in their own values (Deci and Ryan, 2000). In organizations, this social context includes supervisors and coworkers, and impacts intrinsic motivation.

Supervisor support refers to the overall level of helpful social interaction available on the job from supervisors (Karasek and Tbeorell, 1990), and the importance of supportive supervisors has been recognized in previous literature. For example, Van Yperen and Hagedoorn (2003) argue that feeling valued and supported by supervisors makes the work environment more pleasant and rewarding, which may support employees' intrinsic motivation. Other studies also find that support from supervisors satisfies employees' need for relatedness (Baard *et al.*, 2004; Deci *et al.*, 2001), and encouraging (but not controlling) messages from management enhance employees' self-determination (Deci *et al.*, 1989). Furthermore, Blais and Briere (1992) found that supervisor support positively affected self-determination, which in turn positively affected work performance. In the context of knowledge contribution in IT support work, messages from supervisors that support SAs'

work and knowledge contribution tasks can make SAs feel that their supervisors really care about them and respect their work, which supports their intrinsic motivation.

Coworker support refers to social relationships between coworkers, which involve more than the simple exchange of work-related information (Bacharach *et al.*, 2005). Previous literature has found that coworker support can have positive outcomes because this support motivates employees to help each other (Granovetter, 1982). Gersick *et al.* (2000) even argue that coworker support is valued in its own right. These arguments are consistent with SDT research, which finds that when individuals are supported and encouraged by others, their needs for relatedness are met, which in turn supports intrinsic motivation (Wall *et al.*, 1986). In fact, simply identifying with a group of coworkers may positively influence internalization of group values (James and Greenberg, 1989). In the context of knowledge contribution in IT support work, coworker support can satisfy individuals' needs for relatedness by encouraging knowledge contribution as a group norm, which in turn supports intrinsic motivation to contribute knowledge.

To summarize, the social context found in supervisor and coworker support can support SAs' intrinsic motivation. In such a context, SAs will be more self-motivated to contribute knowledge. Stated formally:

H1. Supervisor support to contribute knowledge is positively associated with intrinsic motivation to contribute knowledge.

H2. Coworker support to contribute knowledge is positively associated with intrinsic motivation to contribute knowledge.

3.3 Intrinsic motivation and external motivation

Previous research has considered intrinsic and external motivation to be individual constructs that can be present simultaneously, and has tried to understand their influences on each other. For example, expectancy value research has found that external rewards may weaken intrinsic motivation (Deci, 1971). Similarly, SDT suggests that external factors and rewards can damage one's intrinsic motivation (Deci *et al.*, 1999). Specifically, Deci *et al.* (1999) conducted a meta-analysis and showed that only external rewards that were unexpected or rewarded regardless of task performance, such as salary, did not weaken intrinsic motivation. These kinds of rewards are distinct from the external motivation offered in exchange for work tasks, such as knowledge contribution. Other studies have also found that there is a negative relationship between external motivation and intrinsic motivation (Eden, 1975), and that the introduction of external rewards can undermine intrinsic motivation (Deckop and Cirka, 2000). While several laboratory experiments have supported the negative relationship between external and intrinsic motivation (Deci *et al.*, 1999; Mossholder, 1980), Gagne and Deci (2005) have called for an examination of this relationship in organizations. Therefore, the authors posit the following:

H3. External motivation negatively impacts intrinsic motivation.

3.4 Intrinsic motivation and knowledge contribution

SDT research has suggested that motivation may mediate the effect of social factors on work tasks. Gagne and Deci (2005) suggest that intrinsic and external motivation influence different task outcomes. Specifically, studies have shown that intrinsic motivation is predictive of tasks that are interesting and challenging (Vansteenkiste *et al.*, 2004) or complex (McGraw, 1978). Furthermore, Blais and Briere (1992) found that encouragement from managers was predictive of self-determination, which in turn was predictive of task performance. Similarly, Gagne and Deci (2005) suggest that autonomy-oriented, or intrinsic, motivation mediates the relationship between contextual factors, such as supervisor and coworker support, and task performance.

Research specific to knowledge contribution also supports these findings. Foss *et al.* (2009) found that intrinsic motivation significantly predicted knowledge sharing in an

engineering firm, though only a single concept of knowledge contribution was studied. Osterloh and Frey (2000) suggest that intrinsic motivation is particularly important when sharing tacit knowledge, which is more difficult to share than explicit knowledge.

As described above, in the context of IT support, challenging knowledge contribution summarizes work that is novel, challenging and complex (Haber and Bailey, 2007). To solve a particular problem, SAs need to understand the exact context and be able to identify many possible causes as well as generate a list of candidate solutions. For example, to implement a system change, the SA must maintain an accurate picture of current and future system states while anticipating issues that may arise from introducing even a small change into a complex system (Velasquez and Weisband, 2008). The novelty and complexity involved in closing tickets is likely transferred to the written summarization that formally concludes those tasks. As such, the process of challenging knowledge contribution – from problem or change identification through solution and summarization – is not straightforward and requires much effort from SAs. Furthermore, interviews with participants indicated that they viewed contributing knowledge via tickets to reflect work that was challenging and difficult. When SAs are intrinsically motivated, they are more like to engage in challenging knowledge contribution. Thus, the authors hypothesize that:

H4a. Intrinsic motivation is positively associated with challenging knowledge contribution.

In contrast, SDT suggests that intrinsic motivation may not affect performance on mundane or boring tasks (Gagne and Deci, 2005). When individuals are intrinsically motivated, they engage in tasks because they enjoy exploring these exciting challenges. In IT support work, writing up the basic, foundational information that appears in general how-to or best practice documents does not represent an exploration of new and exciting challenges. Participants indicated a dislike of writing documentation, because it was mundane. Therefore, individuals may not benefit from mundane knowledge contribution, and are less likely to contribute knowledge via documents when they are intrinsically motivated. Although SDT states there may be benefit from intrinsic motivation in jobs that include both complex, interesting work and boring work that requires discipline (Gagne and Deci, 2005), mundane knowledge contribution in the context studied (i.e. knowledge contribution via documents when KMS use is voluntary) does not require discipline because knowledge contribution is not required. Therefore, the authors hypothesize that:

H4b. Intrinsic motivation is negatively associated with mundane knowledge contribution.

3.5 External motivation and knowledge contribution

Organizational studies based on SDT have found that external motivation positively impacts work tasks that are mundane (Grolnick and Ryan, 1987; McGraw, 1978). Laboratory and education research has also found that external rewards reinforce mundane tasks (McGraw and McCullers, 1979; Amabile *et al.*, 1990). Because mundane knowledge contribution summarizes basic, foundational knowledge, it is cognitively easier for SAs than challenging knowledge contribution. In other words, contributing knowledge via documents is not inherently challenging or complex. To maximize any external gains, SAs must contribute as many pieces of knowledge as possible. In this case, SAs are more likely to minimize the cognitive effort required and contribute knowledge through simple summaries via documents. Therefore, the authors hypothesize that:

H5a. External motivation is positively associated with mundane knowledge contribution.

Conversely, contributing knowledge via tickets can be quite challenging and complex, because SAs must fully understand the contexts and interrelated technology issues surrounding the work tasks. Therefore, it is more challenging for SAs to contribute knowledge via tickets, and more effort is needed for each contribution. When SAs are externally motivated by rewards or promotions, they are likely to minimize effort whenever

possible (Ryan and Deci, 2000). For example, to get rewards for certain amount of knowledge contribution, they are more likely to adopt easier ways of contributing, and less likely to engage in complex problem-solving, which requires more cognitive effort. Previous literature on SDT suggests that external motivation can diminish performance of tasks that are complex or difficult (Gagne and Deci, 2005). In addition, knowledge contribution may be viewed as a prosocial behavior, because sharing knowledge helps other users of the KMS. When viewed this way, previous studies have shown that external rewards and motivation negatively affect prosocial behavior, and in particular, prosocial behavior that is difficult or complex (Frey, 1993). Therefore, the authors hypothesize that:

H5b. External motivation is negatively associated with challenging knowledge contribution.

The research model is presented in Figure 1.

4. Method

In this section, the authors discuss the setting, participants, data collection, measurement and data analysis.

4.1 Setting

The setting for the study was a large Fortune 500 company that provided IT support to external customers. By limiting data collection to a single firm, this study controls for organizational and KMS technology contextual factors that may influence knowledge contribution (Foss *et al.*, 2009). The company had introduced a KMS to help the SAs perform their primary tasks more efficiently by aggregating user data and centralizing knowledge, and use of the KMS was completely voluntary. The KMS integrated data from various internal sources to provide SAs with information needed for particular IT support tasks. The information in the KMS came from knowledge that had been contributed by SAs into the KMS via tickets or documents.

4.2 Measurements

Following Dillman (1978), a cross-sectional questionnaire was created with previously validated items. Supervisor and coworker support were taken from Kulkarni *et al.* (2006). Knowledge contribution was adapted from Durcikova and Brown (2007). Intrinsic and external motivation were adapted from Bock *et al.* (2008). Before implementing the survey, the instrument was reviewed by fellow researchers and practitioners at the company familiar with KMS use, knowledge contribution and the particular KMS being studied. Each question was measured on a 5-point, Likert-type scale, anchored on 1 = strongly disagree to 5 = strongly agree. The final items used in the study are shown in Table I.

Figure 1 Research model

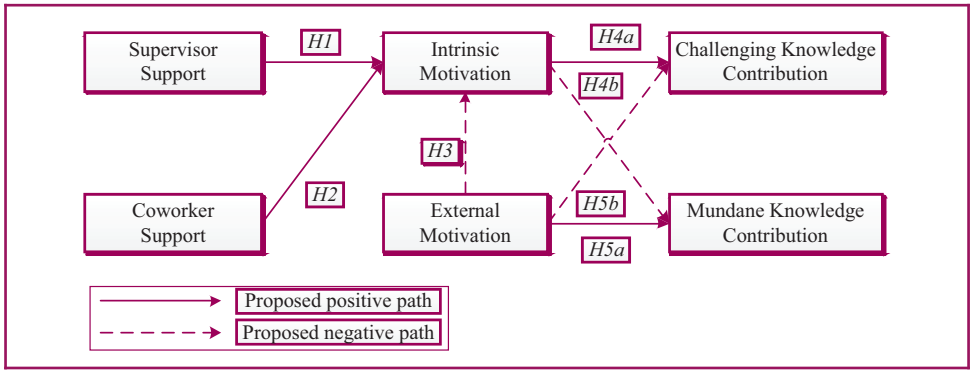


Table I Items and descriptive statistics

Construct	*Item*	*Mean*	*SD*	*Loading*	*CR*
Challenging knowledge contribution	When completing problem tickets, I frequently record comprehensive solution descriptions	3.800	0.765	0.954	0.939
	When working on a problem ticket, I often contribute detailed solutions	3.780	0.799	0.976	
	When solving problem tickets, I am a regular contributor of descriptive solutions	3.719	0.780	0.983	
Coworker support for knowledge contribution	My immediate coworkers encourage open communication even if it means disagreement	3.760	0.740	0.912	0.947
	My immediate coworkers encourage – by action and words – sharing of knowledge	3.800	0.725	0.921	
	My immediate coworkers encourage each other to share solutions to work-related problems	3.790	0.756	0.942	
External motivation	I submit comprehensive solutions because I could get bonuses	2.869	0.954	0.929	0.950
	I submit reusable solutions because I could get a promotion	2.719	0.911	0.911	
	I submit descriptive solutions because I could receive monetary rewards	2.710	0.957	0.946	
Intrinsic motivation	I submit comprehensive solutions because I enjoy helping others	3.750	0.833	0.909	0.889
	I submit reusable solutions because I enjoy earning respect	3.369	0.812	0.701	
	I submit descriptive solutions because I enjoy solving problems	3.790	0.743	0.936	
Mundane knowledge contribution	I frequently submit documents to the SDP document library	2.100	0.980	0.954	0.980
	I often contribute documents to the SDP document library	2.029	0.926	0.976	
	I am a regular contributor to the SDP document library	2.000	0.899	0.983	
Supervisor support for knowledge contribution	My immediate supervisor encourages me to share solutions to work-related problems	3.780	0.860	0.989	0.901
	My immediate supervisor organizes regular meetings to share knowledge	3.439	1.057	0.977	
	My immediate supervisor encourages – by action and words – sharing of knowledge	3.679	0.920	0.954	

4.3 Participants

A web-based survey was used for data collection for ease of distribution and participants' familiarity with web technology. Based on system logs of usage, the survey was distributed to all 431 SA KMS users. Here SAs can be contributors to the KMS, consumers of the knowledge from the KMS or both. Of the population of 431 KMS users, 100 usable questionnaires were completed, a response rate of 23.2 per cent. This response rate might be due to two factors. First, use of the KMS and the type of use (contribution versus consumption of knowledge) was voluntary and the survey was geared primarily toward users as contributors. Second, prior studies have shown that the work of system administration is complex, involves juggling many tasks at once (Barrett *et al.*, 2004; Haber and Bailey, 2007), and takes more than the standard 40-hour work week to complete (SAGE, 2008), which may discourage SAs from taking time to complete the survey (which took approximately 23 minutes on average). Managers' actions in the firm supported this idea by guarding their employees' time and not actively encouraging study participation.

Of the 100 responses, 9 were women (9 per cent). On average, respondents had 4.6 years of work experience in their current position (ranging from 0 to 25 years; SD = 5.07) and 6.64 years of experience in their profession (ranging from 0 to 30 years; SD = 5.96). The demographic profile of the respondents matched the profile of the sampling frame, thus minimizing concerns about nonresponse bias. In addition, early and late respondents were compared in terms of all contextual variables and no significant differences were found in any cases. These results show that nonresponse bias is probably not an issue in this study.

4.4 Analysis

Because common method bias is a potential problem in any study that uses a single data source (Podsakoff *et al.*, 2003), the authors used two statistical tests to evaluate whether common method bias is evident in this data set. First, Harmon's single-factor test (Podsakoff *et al.*, 2003) revealed ten factors explaining 78.2 per cent of the variance, with no single factor featuring significant ($p < 0.10$) loading for all items. Second, the marker variable test (Lindell and Whitney, 2001) showed that, after adjusting for the second smallest positive correlation among the constructs, all originally significant correlations remained significant. Therefore, common method bias is not a problem in this study.

The authors used SmartPLS (Ringle *et al.*, 2005) for testing the research model. The choice of analysis techniques was based on the following three considerations (Hulland, 1999):

1. PLS does not require any assumptions of multivariate normality.
2. PLS works well with small-to-medium sample size.
3. PLS is well-suited to exploratory research.

Consistent with prior research using PLS techniques, the model was analyzed in two stages (Gefen and Straub, 2005). The first stage involved "the assessment of the reliability and the validity of the measurement model", and the second stage deals with "the assessment of the structural model" (Hulland, 1999, p. 198).

In the first stage of assessing the measurement model, convergent validity was established by satisfying the following three criteria (Gefen and Straub, 2005; Hulland, 1999):

1. Each item loaded significantly on their respective constructs, and none of the items loaded on their constructs below the cutoff value of 0.60 (Table I).
2. The composite reliabilities (CRs) of all constructs were over 0.70 (Table I), confirming reliability of the constructs (Chin *et al.*, 2003).
3. The average variance extracted (AVE) of all constructs was over the threshold value of 0.50 (Table II).

Discriminant validity was confirmed by ensuring that the correlations between constructs were below 0.85 (Brown, 2006) and that for each construct, the square root of its AVE exceeded all correlations between that factor and any other construct (Gefen and Straub, 2005) (Table II). Thus, overall, the measures demonstrated good psychometric properties.

Next, the results of the hypothesis testing are presented. Similar to linear regression, PLS examines the significance of construct relationships and provides R^2 measures (Gefen *et al.*, 2000), which represent the amount of variance in the dependent variable explained by the independent variables. Path coefficients can be used to test hypotheses and indicate the strength and significance of relationships between constructs. Together, the R^2 and the path coefficients indicate how well the data support the hypothesized model.

Table II Correlation between constructs, AVE and square-root of AVEs (on diagonal)

Construct	*AVE*	*1*	*2*	*3*	*4*	*5*	*6*
1. Challenging knowledge contribution	0.793	**0.891**					
2. Coworker support	0.853	0.086	**0.924**				
3. External motivation	0.863	−0.031	−0.081	**0.929**			
4. Intrinsic motivation	0.732	0.442	0.258	0.247	**0.856**		
5. Mundane knowledge contribution	0.943	0.167	0.006	0.477	0.135	**0.971**	
6. Supervisor support	0.753	0.403	0.377	0.024	0.335	0.160	**0.868**

Note: Those bold values are just to highlight that they are square root of AVE, not correlation; there are no significance test for those values

The authors first assessed the effects of three control variables (gender, years of work experience in the current position and years of work experience as SAs) on knowledge contribution. The results showed that the two measures of work experience were not significantly related to knowledge contribution. Therefore, the authors did not include them in the hypotheses testing. Gender was significantly related to mundane knowledge contribution. Therefore, gender was included in hypothesis testing.

A rule-of-thumb for PLS sample size is ten times the largest structural equation or the largest measurement equation (Barclay *et al.*, 1995; Gefen *et al.*, 2000). In this case, the largest structural equations had three predictors (e.g. mundane knowledge contribution: one path from intrinsic motivation, one path from external motivation and one path from gender). Therefore, the sample of 100 had sufficient power.

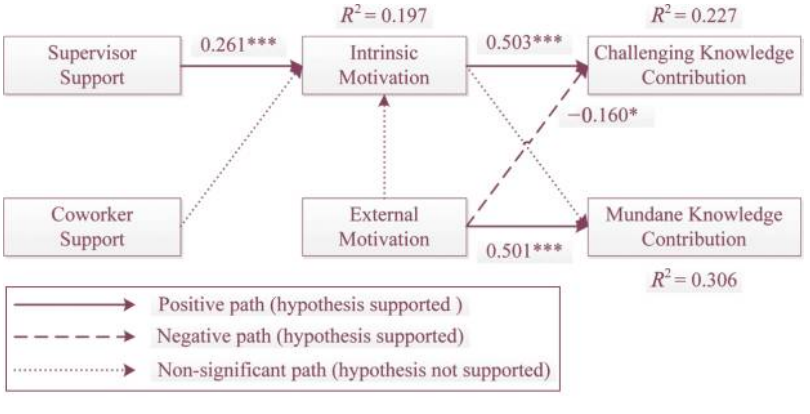
H1 states that supervisor support for knowledge contribution is positively associated with intrinsic motivation to contribute knowledge. This hypothesis is supported ($b = 0.261$, $p < 0.01$). *H2* posits that coworker support for knowledge contribution is positively associated with intrinsic motivation to contribute knowledge. This hypothesis is not supported ($b = 0.181$, $p > 0.05$). *H3* states that external motivation is negatively associated with intrinsic motivation. This hypothesis is not supported ($b = 0.255$, $p > 0.05$). *H4a*, stating that intrinsic motivation is positively associated with challenging knowledge contribution, is supported ($b = 0.503$, $p < 0.001$). *H4b* argues that intrinsic motivation is negatively associated with mundane knowledge contribution. This hypothesis is not supported ($b = -0.048$, $p > 0.05$). *H5a*, which predicts that external motivation is positively associated with mundane knowledge contribution, is supported ($b = 0.501$, $p < 0.001$). *H5b*, stating that external motivation is negatively associated with challenging knowledge contribution, is supported ($b = -0.160$, $p < 0.05$). These results are presented in Figure 2.

Finally, the authors assessed the predictive quality of the model using the Stone – Geisser (Q^2) test (Geisser, 1975; Stone, 1974). When Q^2 is above 0, the model has estimation relevance; values under 0 imply that the model lacks estimation relevance, leading to a doubtful determination of the latent variable. The Q^2 for mundane knowledge contribution is 0.943, the Q^2 for challenging knowledge contribution is 0.793, the Q^2 for intrinsic motivation is 0.731, the Q^2 for external motivation is 0.863, the Q^2 for supervisor support is 0.496 and the Q^2 for coworker support is 0.643. Therefore, the model overall has good predictive relevance.

5. Discussion

While previous literature has examined various factors influencing knowledge contribution, few studies have tried to differentiate various kinds of knowledge contribution tasks. Based on

Figure 2 Emergent model



Notes: *Significant at $p < 0.05$; ***significant at $p < 0.001$

previous literature on KM and psychology (SDT), this study tries to gain a deeper understanding of knowledge contribution by examining how different knowledge contribution tasks are promoted by different types of motivation, and how intrinsic motivation is affected by social factors. The results show that different kinds of motivation lead to different knowledge contribution tasks: while intrinsic motivation is significantly associated with challenging knowledge contribution, external motivation is significantly related to mundane knowledge contribution and negatively related to challenging knowledge contribution. Additionally, supervisor support helps support intrinsic motivation, but coworker support does not. These findings have important theoretical and practical contributions.

5.1 Theoretical contributions

This study has several theoretical implications. First, it shows that knowledge contribution should not be treated as a unitary concept. In the context of IT support, the authors describe two types of knowledge contribution tasks, and argue that these two types of knowledge contribution tasks have different attributes: while contributing knowledge via tickets often summarizes interesting and challenging work, contributing knowledge via documents probably involves mundane and boring contribution tasks. Therefore, for future studies examining knowledge contribution, it is important to specify the type of knowledge contribution being studied, instead of simply treating all types of knowledge contribution as a single construct.

Second, this study shows that different knowledge contribution tasks were promoted by different types of motivation. These findings support the theory of knowledge reuse, which states that organizations must carefully structure incentives to overcome the costs of knowledge contribution (Markus, 2001). In the context of IT support, this study shows that while intrinsic motivation is positively related to challenging knowledge contribution, external motivation is positively associated with mundane knowledge contribution. These results imply that when researchers try to understand the relationship between motivation and knowledge contribution, they need to not only differentiate between knowledge contribution tasks, but also understand various types of motivation. These study results indicate that motivation should not be assumed to be a single concept, and studies examining motivation should explicitly specify the relevant type of motivation (Ryan and Deci, 2000).

Third, this study shows that intrinsic motivation can be supported from organizations. Specifically, the authors find that supervisor support is positively related to intrinsic motivation. That is, supervisors within organizations can have an impact on their employees' intrinsic motivation, which in turn supports complex and challenging knowledge contribution. Future research can continue to investigate how other social factors with organizations can support different types of motivation.

5.2 Practical contributions

This study also has important practical implications. First, practitioners should be aware that there are different types of knowledge contribution tasks. In other words, knowledge contribution should not be treated equally, and it is important for practitioners to understand what types of knowledge contribution (i.e. challenging or mundane) exist in their organizations.

Building on the first, practitioners should recognize that different knowledge contribution tasks are promoted by different types of motivation. In the context of IT support, while intrinsic motivation can promote contributing knowledge via tickets, external motivation can facilitate contributing knowledge via documents. Therefore, organizations may want to emphasize and support different types of motivation depending on what type of knowledge contribution tasks are needed. For example, when a KMS is first deployed and needs supporting documents with general information, organizations may want to emphasize external motivation and motivate SAs to contribute documents into KMS. Once the KMS contains sufficient basic documents and SAs need more detailed knowledge for specific problems, organizations may want to facilitate contributing knowledge via tickets by fostering SAs' intrinsic motivation.

Third, intrinsic motivation can be supported by social factors in organizations. When organizations desire challenging knowledge contribution, supervisors can provide encouraging messages and support for SAs to maintain their intrinsic motivation. When supervisors simply want to accumulate how-to documents, their support may not be needed and extrinsic rewards can be useful in such a context.

5.3 Limitations and opportunities for future studies

This study also has several limitations. The first limitation is that the data were collected from only one organization, and the results may not be able to generalize to other organizations. However, by controlling for variations in KMSs and other organizational factors, the focus on one organization and one KMS enhanced the internal validity of the study. In addition, participant demographics were similar to those found in the SAGE Salary Survey for 2007, implying that the sample had good representativeness to other SAs. Nevertheless, future studies can test and extend this study in other organizations.

Second, the sample is from experienced users of the KMS. Future studies can extend this study with participants who are relatively new to a KMS. Because the attributes of KMSs may also change the motivation of contributors, it is important to examine if the results still hold for new users, and to assess the effect of technical factors of KMSs on different types of motivation.

Another limitation is that the study focuses on a specific context: IT support work, and two specific knowledge contribution tasks in this context. While the results from this study provide insightful understanding of two types of knowledge contribution tasks, they may not be able to generalize to other contexts, especially when there are no corresponding knowledge contribution tasks available. However, the study of SAs does have implications for other knowledge workers who share a community of practice, such as consultants and physicians (Markus, 2001). Furthermore, the authors provide more generalized description of challenging and mundane knowledge contribution. Future studies can adapt these descriptions and examine knowledge contribution tasks in other contexts to see if different types of motivation result in different types of knowledge contribution tasks in these new contexts.

This study is also limited by examining only two types of motivation. On the other hand, the clarification of the differences between external and extrinsic motivation can provide opportunities for future studies to gain a fuller understanding of motivation to contribute knowledge. Without this clarification, the understanding of extrinsic motivation can be limited, given that extrinsic motivation can also be autonomous and lead to valuable results for organizations (Reinholt *et al.*, 2011). Future studies can examine other types of extrinsic motivation (e.g. interjected motivation).

6. Conclusion

Motivating employees to contribute knowledge to KMS remains challenging for organizations. This study develops a theoretical model to examine how various types of motivation results in different types of knowledge contribution tasks. Based on the data collected from a Fortune 500 company, the authors find that while intrinsic motivation is significantly associated with challenging knowledge contribution, external motivation is significantly related to mundane knowledge contribution. These results show that the concept of motivation and knowledge contribution should not be treated as a single construct by researchers. Additionally, practitioners may support employees' different types of motivation, depending on specific knowledge contribution tasks desired. This study is limited by the context and the sample examined, and future studies can extend this study in additional contexts, and further examine additional types of extrinsic motivation.

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